

**Salinity Processes in the Upper Ocean Regional Study**  
**NASA Jet Propulsion Laboratory**  
**Video Transcripts**

**Video: Salinity From Space is Awesome**

**URL:** <https://vimeo.com/58207117> [04:50]

**Description**

Dr. Eric Lindstrom summarizes the history of salinity measurements.

**Transcript**

I have to sort of wind you back a little bit in time to when we just went to sea to do oceanography, and we measured the primary physical characteristics of the ocean: temperature, salinity, and depth. Because with those 3 measurements you can get the density of seawater. The density and its variations from one place to another would drive the circulation.

So we want to know about the density of seawater, and temperature is relatively easy measurement. Salinity is a very difficult measurement, especially at sea. They used to just do chemical means to measure salinity. Then they found out how to measure the conductivity of seawater to get salinity measurements. Still over the whole history of humankind in the sea, we maybe have a couple million salinity measurements of the entire ocean.

We have known since the 1970s how in principle to measure salinity from space, but we didn't have the technology to do it. We knew how to do it, but not the means to do it. By the 1990s technology and antennas and low noise electronics had advanced. I joined headquarters in 1997 as a seagoing oceanographer. I had never done any satellite business. I said, "Hey guys. This is my first day. I want to do salinity from space." And they said, "You're crazy." It only took a few years of investment to prove to NASA headquarters that this was possible, and that this would really entrain the best of NASA engineers in a real good challenge, and of all of that.

So the first thing we did for the first couple years was we invented a measurement of salinity from an aircraft. It was a big antenna hanging out of the back door of a C130 looking at the ocean. We flew it out over the Gulf Stream and proved that they can measure well enough that it would be worthwhile to do this from space. Gary Lagerloef in Seattle, the Principal Investigator for Aquarius, wrote the proposal. It won the competition, you know, amongst many other ideas of what NASA should do next in the satellite realm. So we wound up building this satellite. It was almost a 10 year process to get a satellite in space. So in 2011 it was finally launched.

Back to the main story which is OK, now we can measure temperature and salinity from space at the surface and we can get surface density. The oceanographic trick that you don't know about but maybe I do is that all of the ocean from the top to the bottom is filled with water that was once at the surface, and got its temperature and salinity characteristics at the surface. If you go from the equator to the pole and measure the temperature and salinity along the surface, it is almost the same as measuring temperature and salinity going down at the equator all the way to the bottom, because the coldest water at the bottom of the ocean came from the surface at the pole where it got its properties in winter when it was dense, cold, and salty as it was ever going to get. It sank down along the density surface and it becomes Antarctic bottom water or whatever is filling up the ocean. Actually, if you can examine temperature and salinity at the surface of the ocean, you're actually getting a view of inside the ocean, because if you can see where the densest waters form in winter you can start making estimates of how much it is formed, where it was formed, where it fills the ocean, and we've never had that capability. We can't do it on a ship. You go out on the southern ocean in winter where the water is being formed and you just get beat up. It's not a good place to be in winter. We have very little data from there. But from satellite we can do it.

Understanding the dynamics of the ocean sort of fundamentally from the oceanography 101 level, we get a lot out of just measuring the surface temperature and salinity. Doing it from space is just awesome.